

UK Patent Application (12) GB 2 256 954 (13) A

(43) Date of A publication 23.12.1992

(21) Application No 9212642.4

(22) Date of filing 15.06.1992

(30) Priority data

(31) 9113279

(32) 19.06.1991

(33) GB

(51) INT CL<sup>6</sup>  
H03M 11/14

(52) UK CL (Edition K)  
G4H HKK H13D H14B  
U1S S2197

(56) Documents cited

GB 2212301 A GB 2207780 A GB 2153122 A  
EP 0129286 A1 EP 0043201 A1

(58) Field of search

UK CL (Edition K) G3N NG1A3 NG1A9, G4H HKK  
INT CL<sup>6</sup> G06F, H03M

(71) Applicant  
Marconi Instruments Limited

(Incorporated in the United Kingdom)

Longacres, Hatfield Road, St Albans,  
Herts, AL4 0JN, United Kingdom

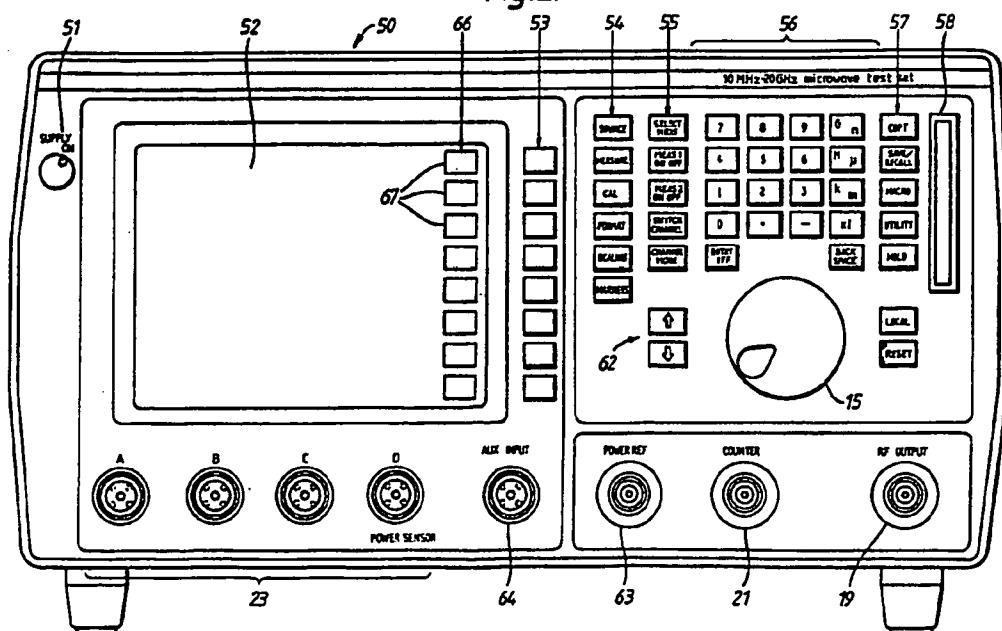
(72) Inventor  
Kimberley Tara Smith

(74) Agent and/or Address for Service  
C F Hoste  
GEC Patent Department, (Wembley Office),  
The General Electric Company plc,  
Hirst Research Centre, East Lane, Wembley,  
Middlesex, HA9 7PP, United Kingdom

(54) A system controlled by manually operable keys

(57) A system, controlled (at least in part) by a plurality of manually operable keys (53) having different functions at different stages of operation, includes a display screen (52) adjacent a control panel, which panel includes said plurality of manually operable keys (53), said system displaying on said screen (52) labels (67) indicating the functions assigned to said keys (53) at the current stage of operation, the labels (67) displayed at each stage of operation together constituting an operation menu (66) comprising a number of options available at that stage, each option being presented as a said label (67) indicating a said key (53) the function of which is to select that option, the operation menus (66) at the various stages of operation together constituting at least one hierarchical series of operation menus, a number of said labels each comprising a geometrical shape, the borders of the labels defining said shapes indicating the functions assigned to and/or the operational status of the corresponding keys (52) at the current stage of operation of said system.

Fig.2.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 256 954 A

19

1/4  
Fig.1.

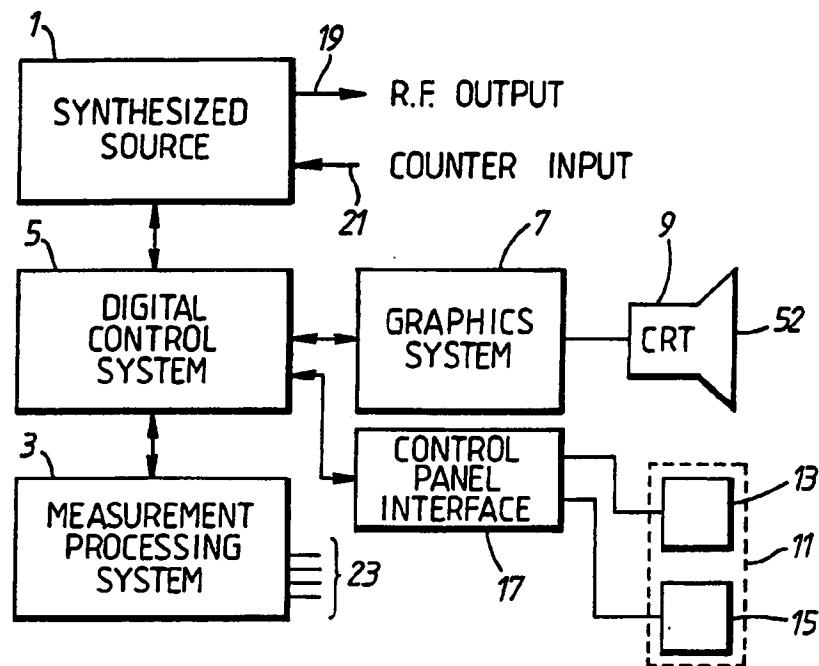


Fig.3.

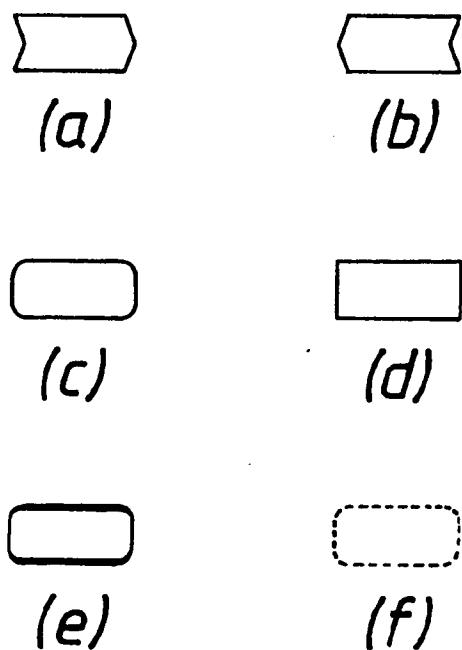


Fig.4.

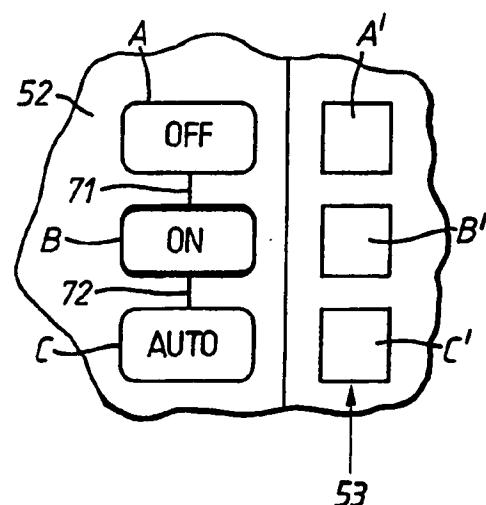
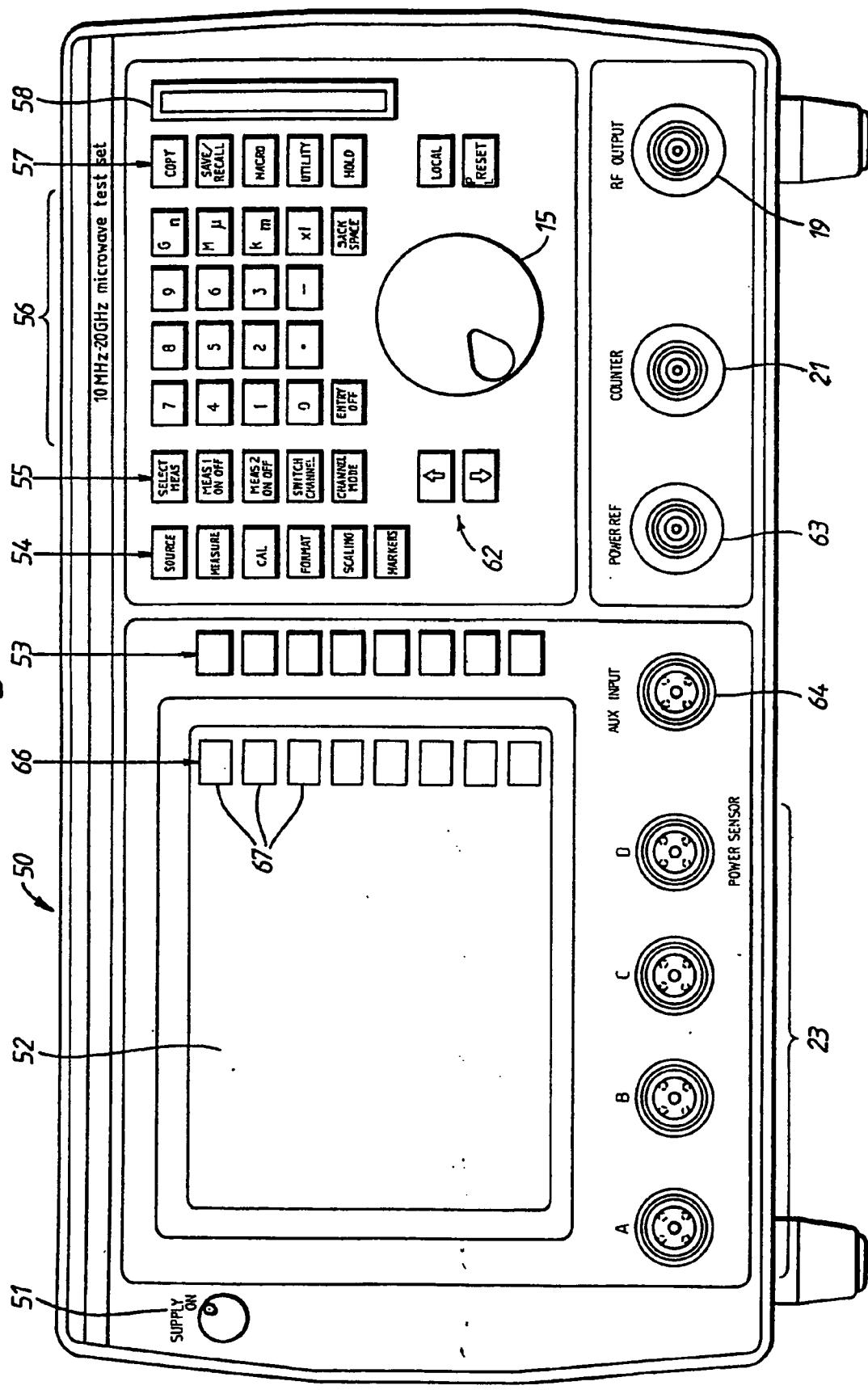


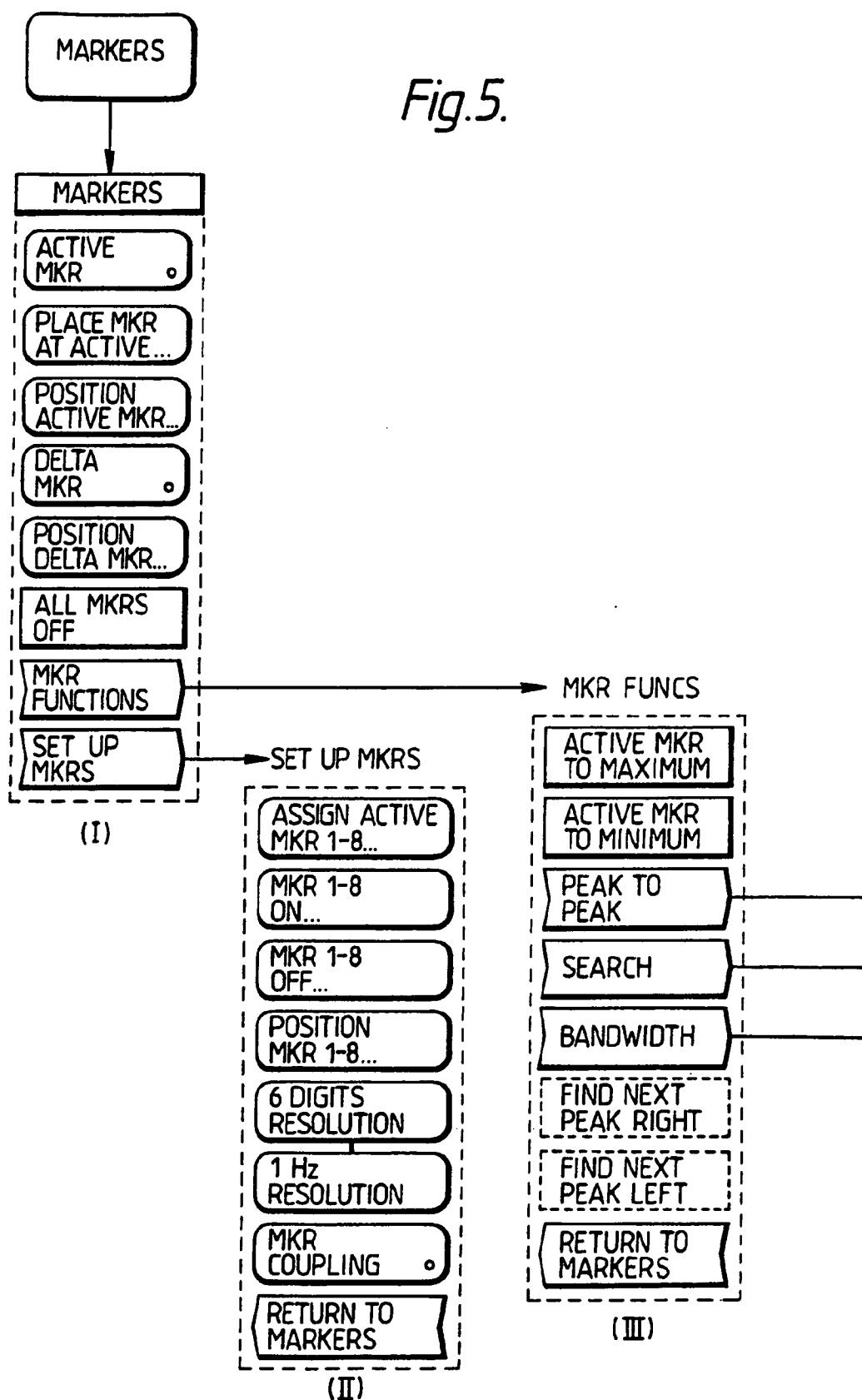
Fig. 2.

2/4



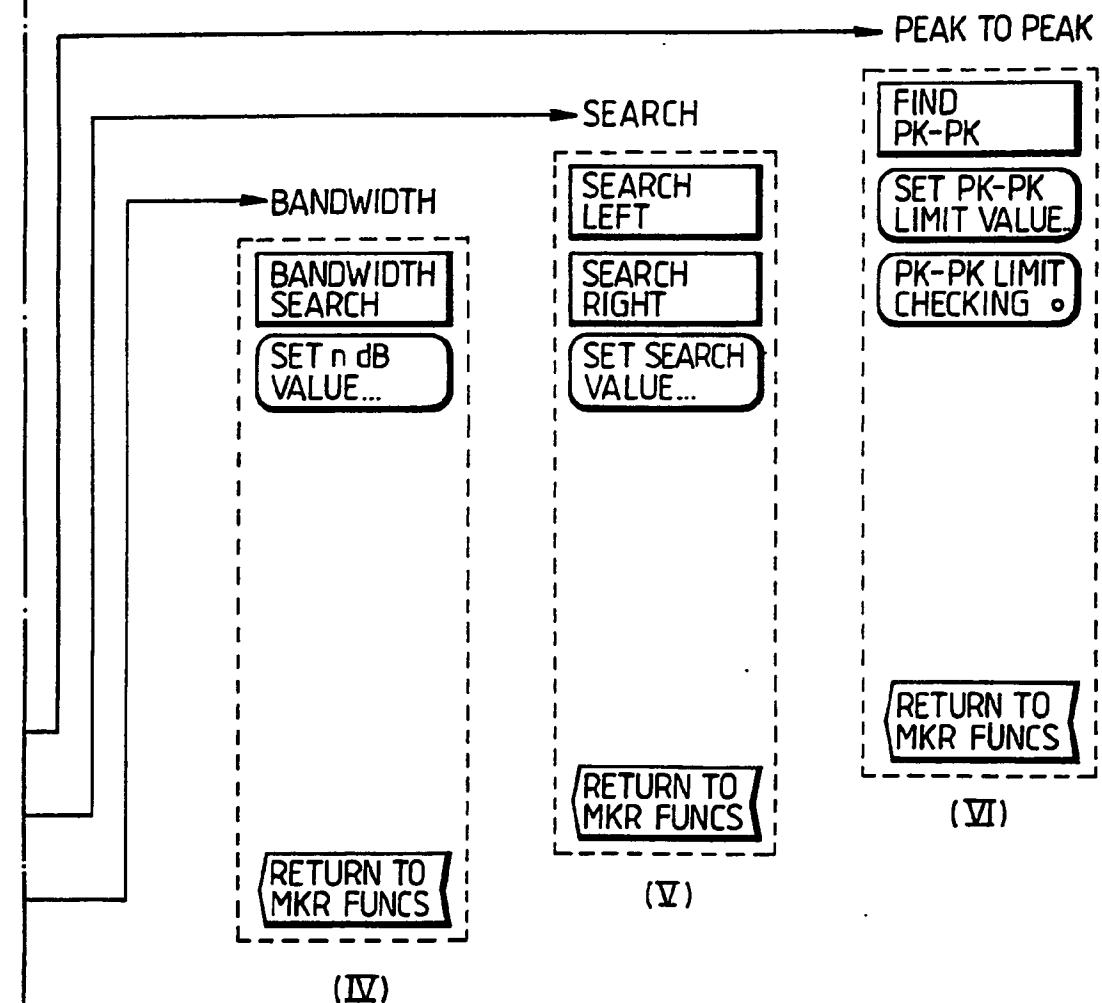
3/4

Fig.5.



44

Fig.5 cont.



-1-

A System controlled by Manually Operable Keys

This invention relates to a system controlled by manually operable keys.

More particularly the invention relates to a system the operation of which is controlled, at least in part, by a plurality of manually operable keys, the functions assigned to the keys by the system being different at different stages of operation of the system, the system including a display screen and adjacent the screen a control panel for operation of the system, which panel includes the plurality of manually operable keys, the system displaying on the screen labels indicating the functions assigned to the keys at the current stage of operation of the system, the labels displayed at each stage of operation together constituting an operation menu of the system comprising a number of options available in operation of the system at that stage, each option being presented as a label indicating a key the function of which is to select that option, the operation menus at the stages of operation of the system together constituting at least one hierarchical series of operation menus of the system.

It is an object of the present invention to provide a system of the above kind with improved ease of use.

According to the present invention there is provided a system the operation of which is controlled, at least in part, by a

plurality of manually operable keys, the functions assigned to said keys by said system being different at different stages of operation of the system, said system including a display screen and adjacent said screen a control panel for operation of said system, which panel includes said plurality of manually operable keys, said system displaying on said screen labels indicating the functions assigned to said keys at the current stage of operation of said system, the labels displayed at each stage of operation together constituting an operation menu of the system comprising a number of options available in operation of the system at that said stage, each option being presented as a said label indicating a said key the function of which is to select that option, the operation menus at the stages of operation of said system together constituting at least one hierarchical series of operation menus of the system, a number of said labels each comprising a geometrical shape, the borders of the labels defining said shapes indicating the functions assigned to and/or the operational status of the corresponding keys at the current stage of operation of said system.

A system controlled by manually operable keys in accordance with the present invention will now be described, by way of example, with reference to the accompanying drawings in which:-

Figure 1 is a block schematic diagram of the system;

Figure 2 is an illustration of a front face of the system;

Figure 3 is an illustration of certain labels, indicating the functions and/or operational status of the manually operable keys, displayed by the system;

Figure 4 illustrates a particular grouping of the labels; and

Figure 5 shows a hierarchical series of operation menus of the system.

Referring to Figure 1, the system comprises a microwave test set (MTS) which provides the functionality of a number of typical bench-top microwave instruments, including a power meter, a frequency counter, a scalar network analyser, and a transmission line fault locator. The MTS comprises

a synthesized source 1, a measurement processing system 3, a digital control system 5, a graphics system 7, a cathode ray tube (CRT) 9, a control panel 11 comprising a key pad 13 and a rotary control 15, and a control panel interface 17.

Source 1 generates at output 19 either a constant or variable (swept) r.f. signal, which if required is applied to a device under test. Part of the hardware of source 1 is also employed to provide the frequency counting capability. A counter input 21 is provided for this purpose. Measurement processing system 3 amplifies and digitises input signals derived from detectors and power sensors, and received by system 3 at inputs 23. Digital control system 5 synchronises source 1 and measurement processing system 3, and processes power measurements received from system 3. System 5 also controls soft keys of key pad 13 and the display of labels on CRT 9 indicating the current function and/or operational status of these soft keys, see below. Measurements are passed to graphics system 7 and displayed thereby on CRT 9. A user operates the MTS by means of control panel 11.

In view of the large number of measurement facilities provided by the MTS it is not practicable to allocate to each function of the operation of the MTS a single, dedicated key of the keypad 13. Thus, as will be explained further below, keypad 13 includes a number of category keys each of which provides access to a number of functions all of which fall within the single broad category of that key. For example, the category might be functions relating to the synthesized source 1, defining the measurement to be performed, or the provision of markers on the display.

Once a category key is pressed, the functions within that category are accessed by means of a hierarchical series of operation menus. Each menu comprises a number of options available in operation of the MTS, each of which options relates to a function within the category in respect of which that menu was provided. As will be explained further below, in addition to the category keys keypad 13 includes a number of soft keys, i.e. keys the functions of

which change during operation of the MTS. Each option of each menu of each hierarchical series is presented as a label displayed on the screen of CRT 9, which label indicates a soft key of keypad 13 the function of which is to select that option. Thus, the soft keys are used to navigate the hierarchical series of operation menus accessed by the dedicated category keys.

Referring also to Figure 2, located in the front face 50 of the MTS there are the following:

**Supply On Switch 51.** Controls the AC power to the MTS.

**Display Screen 52 of CRT 9.** This is used for display of measurement traces and annotations, soft key labels, see below, and other information.

**Soft Keys 53.** The eight soft keys are used to select the desired control and functional options presented by the various menus displayed on screen 52, see below, and accessed through the function, display and system keys, see below, located in face 50.

**Function Keys 54.** These keys are used to control the signal from the synthesized source 1, to define the measurement to be made, to calibrate the measurement system, to format and scale the display, and to set up markers on the display. The keys are therefore labelled SOURCE, MEASURE, CAL, FORMAT, SCALING and MARKERS. The function keys 54 are category keys as mentioned above. Pressing each key 54 provides access to a hierarchical series of operation menus, as the menu 66 in Figure 2, relevant to the category of that key 54. Navigation of the hierarchical series to perform functions within the category is then achieved by means of the eight soft keys 53. Each menu of the hierarchical series comprises a number of options available in operation of the MTS, each of which options is presented as a label, as labels 67 in Figure 2, displayed on screen 52, which label indicates a soft key 53 the function of which is to select that option. A label is provided in respect of each soft key 53 which performs a function in the menu in question. Each label is positioned relative to the other labels as its

corresponding key 53 is positioned relative to the keys 53 corresponding to the other labels. A number of menu options of the MTS are options to use other, dedicated controls of the MTS. An example of such an option is the option to use the numeric entry keys, see below, to set the numerical value of a particular parameter of the MTS.

**Display Keys 55.** These keys determine the number of channels (i.e. areas on screen 52 where measurements are displayed) and measurements displayed, the channel mode (i.e. the type of measurements the channel displays), and which channel or measurement is active (the active channel contains the currently active measurement, a measurement's attributes may be changed when it is active). The display keys 55 are labelled MEAS 1 ON/OFF, MEAS 2 ON/OFF, SELECT MEAS, SWITCH CHANNEL and CHANNEL MODE.

**Numeric Entry and Terminator Keys 56.** These keys are used for entering values of numeric parameters and other numeric entries.

**System Keys 57.** These keys control system functions including instrument preset, instrument settings save/recall functions, plotter and printer control, setting up the GPIB (general purpose interface bus) mode, and built-in diagnostic tests. These keys are labelled COPY, SAVE/RECALL, MACRO, UTILITY, HOLD, LOCAL AND PRESET.

**Memory Card Slot 58.** Accepts plug-in memory cards containing non-volatile RAM that can be used for extending the number of instrument stores and installing software options (e.g. Fault Location).

**RF Output Connector 19** (see also Figure 1). This is a precision connector for the RF output signal of source 1.

**Rotary Control 15** (see also Figure 1). Adjustments may be made to a parameter value using the rotary control 15.

**Counter Connector 21** (see also Figure 1). This input is used when measuring the frequency of a signal.

**Step Keys 62.** The step keys are used to step the current value of a

parameter up or down.

**Power Ref Connector 63.** This connector provides a 50 MHz, 1mW reference signal that is used to calibrate power sensors before taking any measurements.

**Aux Input Connector 64.** This is used to connect add-on hardware options to the MTS.

**Input Connectors 23** (see also Figure 1). Connectors A, B, C and D accept 12 pin connectors from the detector cable assemblies. Input D can also be configured to accept a power meter sensor when power meter accuracy is required.

The keypad 13 of Figure 1 comprises the keys 53, 54, 55, 56, 57 and 62.

Referring also to Figure 3, certain of the soft key labels 67 displayed by screen 52 have borders which indicate the functions assigned to and/or the operational status of the corresponding keys 53 at the current stage of operation of the MTS. The borders indicate pictorially the functions and/or operational status of the corresponding keys 53. Thus, a user of the MTS is able at a glance at the borders to realise information regarding the functions and/or operational status of the corresponding keys 53, hence easing operation of the MTS.

Label (a) is that displayed to indicate a key 53 to instruct the MTS to move to a menu lower in a hierarchical series. Label (a) has a border defining a box-shaped arrow pointing to the right.

Label (b) is that displayed to indicate a key 53 to instruct the MTS to move to a menu higher in a hierarchical series. Label (b) has a border defining a box-shaped arrow pointing to the left.

Label (d) is that displayed to indicate a key 53 to instruct the MTS to perform an operational function of the MTS, for example the function of aborting a currently under way self calibration of the MTS. Label (d) has a border comprising a rectangle.

Labels (c) and (e) indicate keys 53 having operational status of not selected, i.e. off, and selected, i.e. on, respectively. The borders of both labels (c) and (e) comprise rectangles with rounded corners, but the MTS indicates that the key 53 corresponding to label (e) has an operational status of selected by highlighting the top and bottom sides of the label, as represented by the thickened lining.

As labels (c) and (e), label (f) has a border comprising a rectangle with rounded corners. However, the border of label (f) is dotted in form which indicates that the corresponding key 53 has an operational status of not selectable, i.e. whilst the menu is displayed in which label (f) appears the corresponding key 53 performs no function.

Labels (a) to (f) typically include therein textual wording providing further information regarding the functions of the corresponding keys 53. For example, if the operational function of the MTS performed on pressing the key 53 corresponding to label (d) were the abortion of a currently under way self calibration of the MTS, then the expression 'Abort Calibration' would suitably be included in label (d).

Referring to Figure 4, the three labels A, B, C displayed on screen 52, indicating the current functions of the three keys A', B', C' respectively, are tied together by lines 71, 72 displayed on screen 52. Such tying together indicates that the functions of the three keys A', B', C' are mutually exclusive, that is it is not possible to select simultaneously any two of or all three of the functions.

Labels A, B, C indicate that the mutually exclusive functions of the keys A', B', C' are the switching off of a function of the MTS, the switching on of this function of the MTS, and the selection of the automatic control of the switching on and off of this function of the MTS, respectively. The top and bottom sides of label B are highlighted indicating, see label (e) of Figure 3, that the function of the MTS is switched on.

Figure 5 shows the hierarchical series of operation menus accessed by pressing the MARKERS function key 54 when swept scalar measurements are being made.

A maximum of eight markers can be used to mark points of interest on a measurement trace. They are displayed as small numbered flags. One marker is designated the active marker, and is used to make a spot measurement at a point on the trace. When a so called delta marker is enabled, the spot measurement displayed is the difference between that at the active marker and that at the delta marker. The markers menu hierarchy shown in Figure 5 provides functions to allow markers to be positioned on the trace, to assign one marker to be the active marker, to enable or disable delta marker measurements, and to activate special measurement functions such as bandwidth or peak to peak ripple.

Of the soft key labels shown in Figure 5 certain exemplify the use, previously described, of the borders thereof to indicate the functions and/or operational status of the corresponding soft keys. These are as follows.

In menus (i), (iii), (iv), (v) and (vi) there are labels indicating keys to instruct the MTS to perform the operational functions All Mkrs Off, Active Mkr to Maximum, Active Mkr to Minimum, Bandwidth Search, Search Left, Search Right, and Find Pk-Pk. These labels therefore have borders defining rectangles, cf. label (d) in Figure 3.

In menus (i) and (iii) there are labels indicating keys to instruct the MTS to move to the following menus lower in the hierarchical series, Set Up Mkrs, Mkr Funcs, Bandwidth, Search and Peak to Peak menus. These labels therefore have borders defining box-shaped arrows pointing to the right, cf. label (a) in Figure 3.

In menus (ii), (iii), (iv), (v) and (vi) there are labels indicating keys to instruct the MTS to move to Mkr Funcs and Markers menus higher in the hierarchical series. These labels therefore have borders defining box-shaped arrows pointing to the left, cf. label (b) in Figure 3.

In menu (ii) there are two labels indicating keys the functions of which are selecting 6 Digits Resolution and 1 Hz Resolution and are mutually exclusive. The borders of these two labels are therefore tied by a short vertical line, cf. labels A, B, C in Figure 4. The currently selected resolution would be indicated by highlighting the top and bottom sides of the relevant label, cf. label B in Figure 4.

In menu (iii) there are two labels indicating keys to instruct the MTS to perform the operational functions Find Next Peak Right and Find Next Peak Left. However, these functions are only available when fault location measurements are being made, not swept scalar measurements, see above, and are therefore not selectable. The two labels therefore have dotted rectangular borders, cf. labels (f) and (d) in Figure 3.

CLAIMS

1. A system the operation of which is controlled, at least in part, by a plurality of manually operable keys, the functions assigned to said keys by said system being different at different stages of operation of the system, said system including a display screen and adjacent said screen a control panel for operation of said system, which panel includes said plurality of manually operable keys, said system displaying on said screen labels indicating the functions assigned to said keys at the current stage of operation of said system, the labels displayed at each stage of operation together constituting an operation menu of the system comprising a number of options available in operation of the system at that said stage, each option being presented as a said label indicating a said key the function of which is to select that option, the operation menus at the stages of operation of said system together constituting at least one hierarchical series of operation menus of the system, a number of said labels each comprising a geometrical shape, the borders of the labels defining said shapes indicating the functions assigned to and/or the operational status of the corresponding keys at the current stage of operation of said system.
2. A system according to Claim 1 wherein: said plurality of keys extend along a side of said screen; there is one said label in respect of each said key; and each said label is positioned relative to the other said labels as its corresponding key is positioned relative to the other said keys.
3. A system according to Claim 1 or Claim 2 wherein said control panel includes a number of dedicated category keys, the function of each of which is to provide access to a said hierarchical series of operations menus relevant to the category of that key.
4. A system according to Claim 1 or Claim 2 or Claim 3 wherein a said option available is the option to use dedicated further controls of said control panel.
5. A system according to any one of the preceding claims which

is a measurement instrument, said instrument comprising: receiver means for receiving a measurement input; digitizer means for digitising the measurement input; processor means for processing the measurement input, said processor means additionally controlling said plurality of keys; a graphics system for displaying the measurement on said display screen, said graphics system additionally displaying on said screen under the control of said processor means said labels; and a control panel interface between said control panel and said processor means.

6. A system according to any one of the preceding claims wherein a said option available is the movement to a menu higher in a said hierarchical series, the option being presented as a said label having a border defining a box-shaped arrow pointing to the left.

7. A system according to any one of the preceding claims wherein a said option available is the movement to a menu lower in a said hierarchical series, the option being presented as a said label having a border defining a box-shaped arrow pointing to the right.

8. A system according to any one of the preceding claims wherein a said option available is the performance of an operational function of the system, the option being presented as a said label having a border defining a rectangle.

9. A system according to any one of the preceding claims which indicates that a key of said plurality has an operational status of selected by highlighting a proportion of the border of the corresponding label.

10. A system according to Claim 9 wherein the label a proportion of the border of which is highlighted has a border defining a rectangle with rounded corners, the proportion of the border highlighted being the top and bottom sides of the rectangle.

11. A system according to any one of the preceding claims which indicates that a key of said plurality has an operational status of not selectable by displaying the border of the corresponding label dotted in form.

12. A system according to any one of the preceding claims wherein the borders of two or more of the labels displayed on the display screen are tied together by lines displayed on the display screen extending between the borders, said tying together indicating that the keys of said plurality corresponding to said two or more labels have functions which are mutually exclusive.

13. A system according to Claim 12 wherein: said two or more labels each comprise a rectangle with rounded corners; and when the function of one of the keys corresponding to said two or more labels is selected, the top and bottom sides of the label corresponding to that one key are highlighted.

14. A system controlled by manually operable keys substantially as hereinbefore described with reference to the accompanying drawings.

## Relevant Technical fields

(i) UK CI (Edition K ) G4H (HKK), G3N (NG1A3, NG1A9)

(ii) Int CI (Edition 5 ) G06F, H03M

Search Examiner

M J DAVIS

## Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

7 JULY 1992

## Documents considered relevant following a search in respect of claims

1-14

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2212301 A (TOKAI KOGYO MISHIN) - whole document	1 at least
X	GB 2207780 A (TOKAI KOGYO MISHIN) - whole document	1 at least
X	GB 2153122 A (GARDNER) - whole document	1 at least
X	EP 0129286 A1 (PHILIPS) - especially page 6 line 6 to page 7 line 8, and page 10 lines 2-9	1 at least
X	EP 0043201 A1 (FORNEY) - whole document eg abstract	1 at least

Category	Identity of document and relevant passages	Relevant to claim(s)

#### Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

**Databases:** The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).